Data Record of Adult Sockeye Salmon and Other Fish Species Captured by Purse Seine in Queen Charlotte Strait, Johnstone Strait and the Strait of Georgia in 1985 and1986

K. Cooke, R. Hungar, C. Groot, and G. Tolson

Department of Fisheries and Oceans
Fisheries Research Branch
Pacific Biological Station
Nanaimo, British Columbia V9R 5K6

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DATA RECORD OF ADULT SOCKEYE SALMON AND OTHER FISH SPECIES CAPTURED BY PURSE SEINE IN QUEEN CHARLOTTE STRAIT, JOHNSTONE STRAIT AND THE STRAIT OF GEORGIA IN 1985 AND 1986

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K. Cooke, R. Hungar, C. Groot, and G. Tolson

Department of Fisheries and Oceans
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ABSTRACT

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This data record summarizes catch information on the distribution of adult sockeye salmon (Oncorhynchus nerka) and other fish species captured in Queen Charlotte and Johnstone Straits and the Strait of Georgia. The collections were made by purse seine during the summer months of 1985 and 1986. Stomach content data is presented for some of the sockeye captured.

Key words: salmon, sockeye, adult, distribution, Queen Charlotte Strait, Johnstone Strait, Strait of Georgia, stomach contents

RÉSUMÉ

Cooke K., R. Hungar, C. Groot, and G. Tolson. 1987. Data record of adult sockeye salmon and other fish species captured by purse seine in Queen Charlotte Strait, Johnstone Strait and the Strait of Georgia in 1985 and 1986. Can. Data Rep. Fish. Aquat. Sci. 680: 127 p.

Le présent fichier de données est un résumé de l'information sur la répartition du saumon rouge (Oncorhynchus nerka) adulte et d'autres espèces de poisson capturés dans les détroits de Reine-Charlotte, de Johnstone et de Géorgie. Les prélèvements ont été effectués à la senne coulissante pendant l'été de 1985 et 1986. On présente aussi des données sur les contenus stomacaux de certains des saumons rouges capturés.

Mots clés: saumon rouge, adulte, répartition, détroit de Reine-Charlotte, détroit de Johnstone, détroit de Géorgie, contenus stomacaux

INTRODUCTION

This data record summarizes catch information on the distribution of adult sockeye salmon (Oncorhynchus nerka) and other fish species captured by purse seine in Queen Charlotte and Johnstone straits and the Strait of Georgia during July and August, 1985 and July through September, 1986. The collections form part of a study initiated in 1982 to investigate migratory patterns of sockeye salmon of Fraser River origin (Cooke and Groot 1986; Groot and Quinn 1986).

Sockeye salmon migrating to the Fraser River can enter the Strait of Georgia either from the north through Queen Charlotte and Johnstone straits or from the south through Juan de Fuca Strait. The proportion of the total run of sockeye salmon using the northern route has varied from less than 5% to more than 80% since 1953 (IPSFC 1954-1985). Our inability to predict the route selection creates significant problems with stock management and catch allocations. Information gathered on sockeye salmon distributions and factors influencing migratory patterns would assist managers in forecasting coastal movements and stock assessment.

The survey program was designed to provide information on the vertical and horizontal distributions and movements of adult sockeye salmon migrating through nearshore waters. Techniques employed included hydroacoustic assessment of relative abundance of fish stocks (Hungar, unpublished data) and radio telemetry studies of individual fish movements (Quinn and Terhart 1986). Samples were also collected for stock identification using parasite analysis (Margolis 1982) and scale characteristics (Henry 1961). Feeding behavior of homeward migrating sockeye salmon was studied using stomach content analysis.

METHODS

FISHING GEAR AND OPERATION

Fishing operations in 1985 were conducted from the commercial fishing vessel Sea Luck chartered to the Department of Fisheries and Oceans under contract number FP597-5-0968. The Sea Luck is an aluminum drum seiner, 18 m in length and 2.8 m in draft, powered by a 365 hp CAT D433 engine and equipped with bow thrusters. In 1986, the department chartered the commercial seiners Nafco and Cape Canso under contract numbers VC86-43 and VC86-42, respectively. The Nafco is a 21 m wooden seiner with a draft of 2.7 m, powered by a 340 hp GM V12.71 engine and equipped with bow thrusters. The Cape Canso is a wooden seiner 24 m in length, with a 2.7 m draft, powered by a 365 hp CAT D343 engine and equipped with bow thrusters. The nets used were commercial salmon purse seines measuring 400 m long by 52 m deep, with a bunt

end mesh size of 76 mm and a leadline weighing about 3 kg/m (Fig. 2). Each seiner used a skiff in the setting of the net.

Sampling operations were carried out during non-commercial fishing days which effectively allowed for 2-3 days fishing per week depending upon duration of commercial openings and distance from fishing grounds. The seine sets in 1985 were originally intended to provide verification, species composition and relative abundance of fish sightings recorded hydroacoustically on an accompanying Fisheries Research vessel. However, lack of detectable signals on the echograms indicated that a survey using catch per unit effort data (CPUE) from the Sea Luck would be more productive in determining salmon movements than would a hydroacoustic survey (Hungar unpublished data). The CPUE survey design was also employed in 1986 with the Nafco and Cape Canso.

All sets were carried out during daylight hours, generally beginning at sunrise and continuing until early afternoon. Some evening sets were made when weather and/or tidal conditions dictated fishing times or when recoveries of some tagged fish were requested (Quinn et al. 1986). Some repeat sets were made in order to increase sample size from a particular area or to examine relative abundance of stocks at various tidal stages.

The gear was usually set in a closed circle lasting about 5 to 10 min between "shooting" and "pursing". Open or towed sets were also employed; duration of the tow was limited to about 10 min. The net was usually emptied and back on the drum within 45 min.

SURVEY AREA

The study area was divided into three geographic zones: Area 1) Queen Charlotte Strait and upper Johnstone Strait, Area 2) lower Johnstone Strait and Discovery Passage, and Area 3) Strait of Georgia. Sets S1 through S9 on July 18, 1985 (Fig. 3c) represent fishing locations along nine transects across Johnstone Strait relating to hydroacoustic survey methods described earlier. A total of 104 sets were made in 1985 independent of the hydroacoustic survey. Thirty-five sets were made in Area 1, 33 in Area 2, and 36 in Area 3. In 1986 the Nafco set 104 times: 43 in Area 1 and 53 in Area 3. Eight sets were made in Juan de Fuca Strait. The Cape Canso set 71 times in Area 1, 12 in Area 2, and 48 in Area 3 for a total of 131 sets.

We began our sampling in Queen Charlotte Strait on July 4, 1985. Sets were made on a line from the north shore of Malcolm Island across Queen Charlotte Strait to Salmon Channel. Some sets were also made near the Gordon Group Islands. Operations progressed southward through Johnstone Strait to Discovery Passage from July 11 until Aug. 2, 1985. From Aug. 3 until Aug. 30, 1985 operations continued throughout northern and central sections in the Strait of Georgia. Set locations are plotted in Figures 3a and b. The 1986 survey began with the Nafco on July 24 in Queen Charlotte Strait. The Cape Canso charter began one week later on July 31 in the same area. Sets were concentrated in Goletas and Gordon channels with some exploration across Richards Channel to the mainland coast. Much of the fishing effort from

August 14 to 30, 1986 was centered in upper Johnstone Strait and central Queen Charlotte Strait. During the last week of August 1986, the Nafco travelled southward to secure fish for charter payment in Juan de Fuca Strait. It remained in Area 3 to September 13, 1986, fishing primarily in Malaspina Strait, Sabine Channel and off of the Fraser River. The Cape Canso worked the north and central portions of the Strait of Georgia from September 1 to 13, 1986. Set location in 1986 are plotted in Figures 4a and 6.

DATA COLLECTION AND SAMPLE ANALYSIS

All species of fish were identified and counted or, when abundant, estimated from each set. Catch distribution data is plotted in Figures 5a and b for 1985 and 6a and b for 1986.

The number of sockeye retained from each set was determined at the time of capture and varied according to the availability of fish in each area. Numbers of sockeye captured and the proportions sampled from each set are reported in Table 1a-b. Sockeye not needed for samples and all other species of fish caught were released.

Scales were taken and hypural lengths were recorded on board the vessels. All samples were disc tagged for individual identification and stored frozen for later analysis at the Pacific Biological Station. Stock identification samples from Area 3 were processed incorrectly in 1985 and were therefore unavailable for analysis. Sockeye collected for foraging studies were also sexed and their digestive tracts were preserved in 10% buffered formalin for analysis. Stomach content data are summarized in Tables 2a and b.

ENVIRONMENTAL AND OCEANOGRAPHIC OBSERVATIONS

At the completion of each set, a number of weather observations were recorded based on the coding instructions given below. These codes are used in the tables containing the catch data. Sea surface temperatures and observed tidal flow were also reported. Tide height and time information were taken from the appropriate reference ports designated in the Canadian Tide and Current Tables (1985, 1986).

ACKNOWLEDGMENTS

We would like to express our thanks to Captain A. Recalma of the Sea Luck, Captain H. Jagger of the Nafco and Captain G. Wasden of the Cape Canso and their crews for their efforts throughout the project and for sharing their knowledge of fish movements with us. We are indebted to observers D. Dowe and G. Workman for collecting and recording the data.

ENVIRONMENTAL DATA CODING

TIME: Pacific Standard Time

LOCATION: Indicate general area and chart and set number

WATER TEMP: Surface temperature in °C to nearest 0.1°

SUN:

0 -- not visible at all
1 -- orb not visible, but there is a bright area in sky
2 -- orb visible, but through thin clouds or haze
3 -- sun unobscured

MOON:

Multiply	Brightness		by	Phase	
	invisible	0		0-10%	0
	vague	1		10-40%	1
	moderate	2		50-80%	2
	bright	3		full moon	3

STARS:

0 -- invisible
1 -- vaguely visible
2 -- moderately visible
3 -- bright

CLOUDS: **Type:**

0 -- clear sky
1 -- transparent clouds (haze, cirrus), sun orb visible through them
2 -- white clouds
3 -- grey clouds

%: % of total sky covered by clouds at time of observation

VISIBILITY: Horizontal visibility

0 -- less than 50 m (55 yards)
1 -- 50 m-1/2 km (55-550 yards)
2 -- 1/2 km-1 km (550-1100 yards)
3 -- 1 km-5 km (5/8-3 nautical miles)
4 -- 5 km-10 km (3-6 nautical miles)
5 -- greater than 10 km (over 6 nautical miles)

WIND: **Force:**

Code	Sea state	Speed
0	Like a mirror	(<2 km/hr)
1	Rippled	(2-6 km/hr)
2	wavelets, not breaking	(7-11 km/hr)
3	scattered whitecaps	(12-18 km/hr)
4	frequent waves	(19-29 km/hr)
5	moderate waves	(30-38 km/hr)
6	Large waves and spray	(39-49 km/hr)
7	foam streaks	(50-60 km/hr)
8	crests breaking into spindrift	(61-73 km/hr)
9	crests toppling	(74-85 km/hr)

WIND: (cont'd)

Direction: Record the direction from which the wind is blowing using magnetic degrees

1 = 6 - 15°	19 = 186 - 195
2 = 16 - 25	20 = 196 - 205
3 = 26 - 35	21 = 206 - 215
4 = 36 - 45	22 = 216 - 225
5 = 46 - 55	23 = 226 - 235
6 = 56 - 65	24 = 236 - 245
7 = 66 - 75	25 = 246 - 255
8 = 76 - 85	26 = 256 - 265
9 = 86 - 95	27 = 266 - 275
10 = 96 - 105	28 = 276 - 285
11 = 106 - 115	29 = 286 - 295
12 = 116 - 125	30 = 296 - 305
13 = 126 - 135	31 = 306 - 315
14 = 136 - 145	32 = 316 - 325
15 = 146 - 155	33 = 326 - 335
16 = 156 - 165	34 = 336 - 345
17 = 166 - 175	35 = 346 - 355
18 = 176 - 185	36 = 356 - 365

WAVES: Height:

0 -- Flat calm
1 -- <15 cm (6 inches)
2 -- 15-30 cm (6-12 inches)
3 -- 30-60 cm (1-2 feet)
4 -- 60-90 cm (2-3 feet)

5 -- 90-150 cm (3-5 feet)
6 -- 150-210 cm (5-7 feet)

Direction:

Record the direction from which waves come using magnetic degrees.

(for code see wind direction)

RAIN: Type

0 -- no rain
1 -- light rain
2 -- heavy rain

Duration: to nearest 10% of time since previous reading

OBSERVED TIDE: EBB, FLOOD, or compass direction to which current flows in open water. These are surface-visual observations.

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Pages 7 through 106 do not appear in paper, but appear in microfiche form at the back of this report.

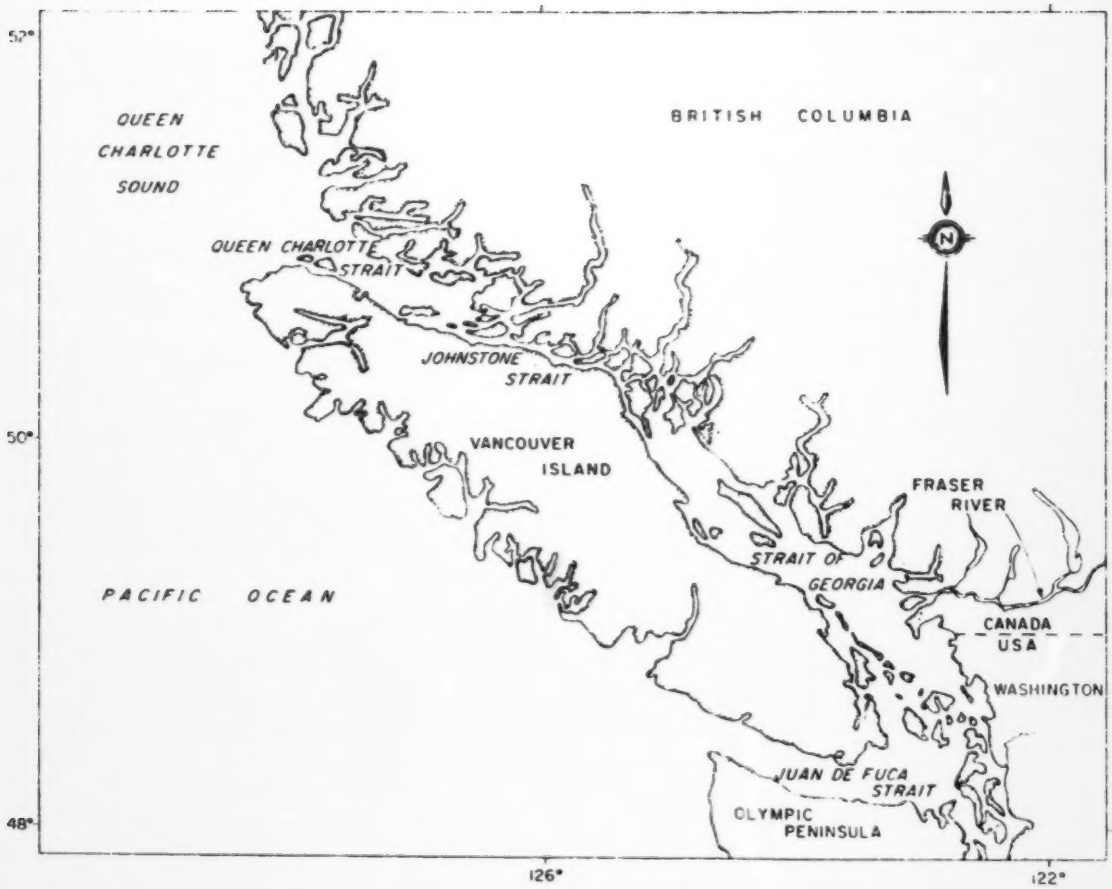

Fig. 1. Study area.

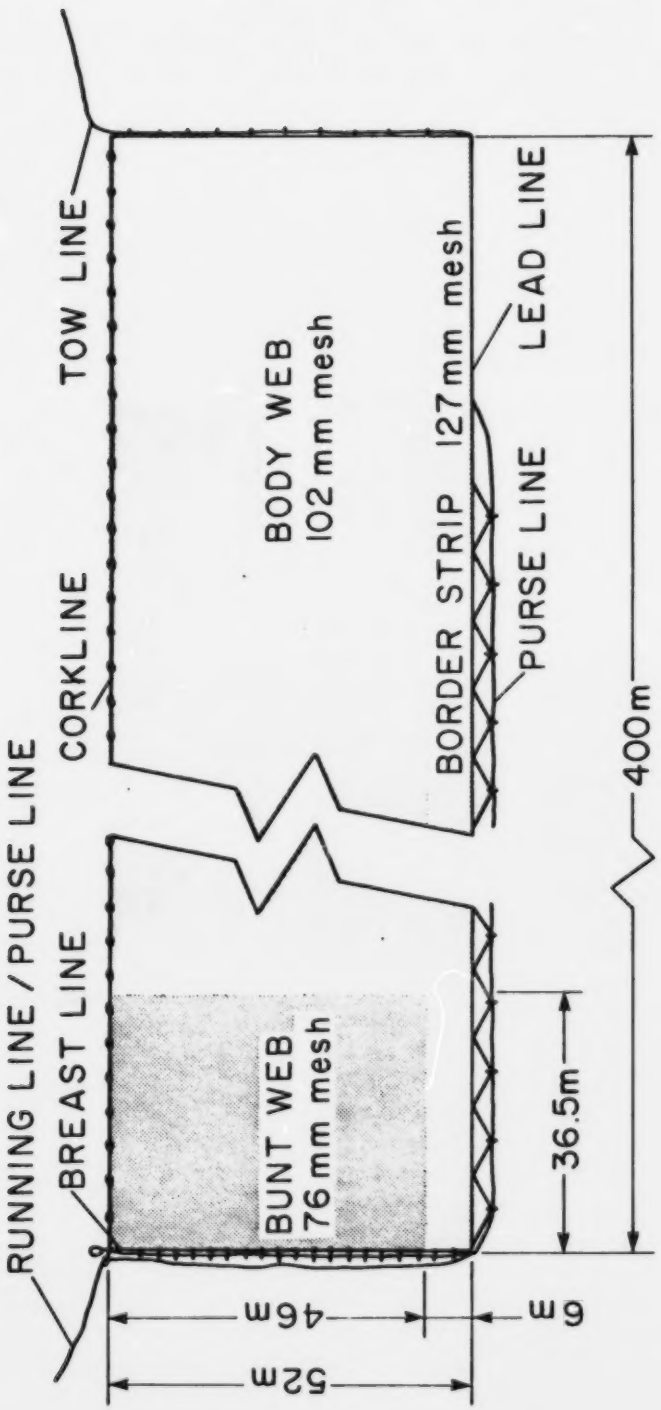

Fig. 2. Detail of commercial purse seine used in study.

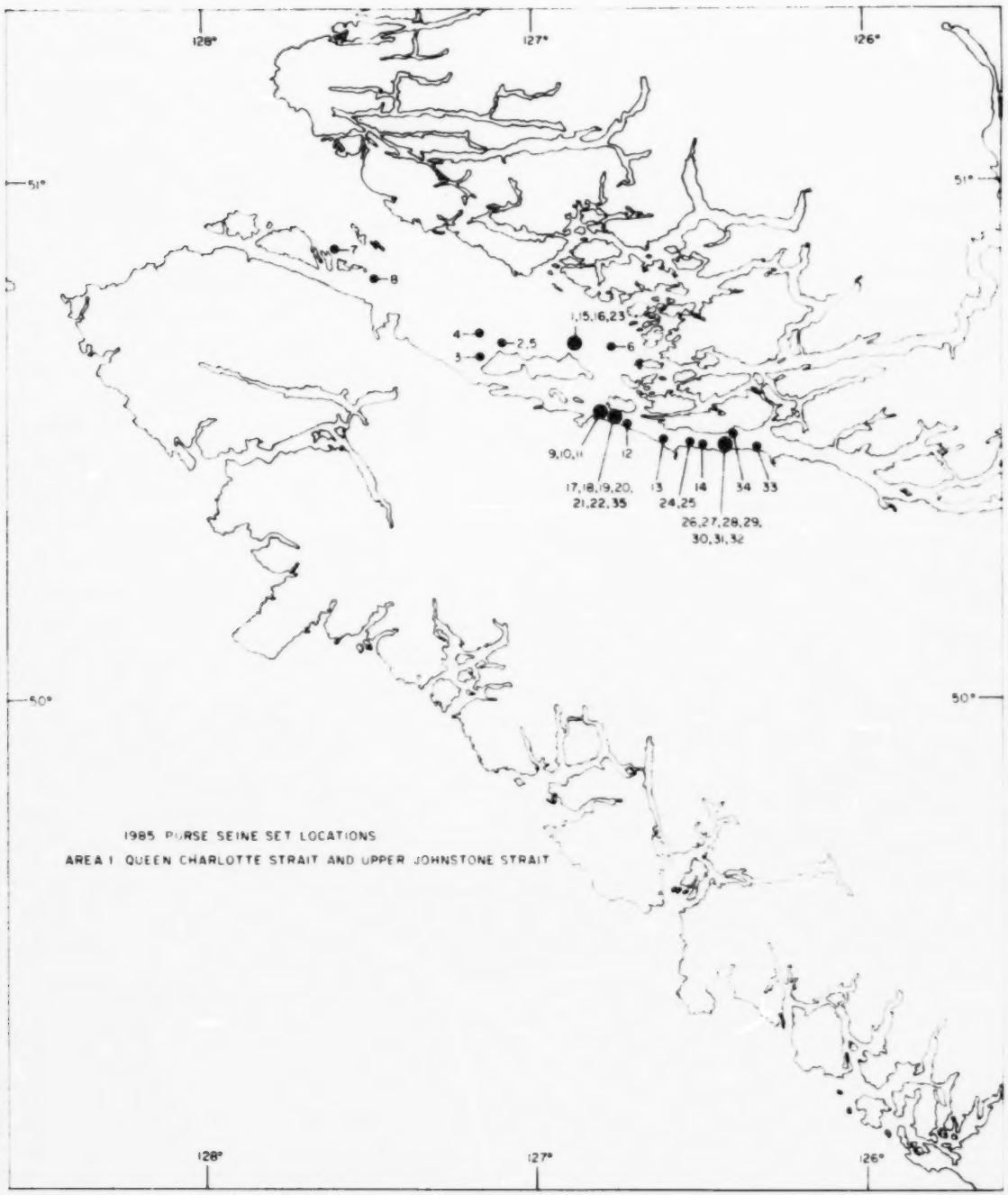

Fig. 3a. Sea Luck set location in 1985, Area 1: Queen Charlotte and upper Johnstone Strait.

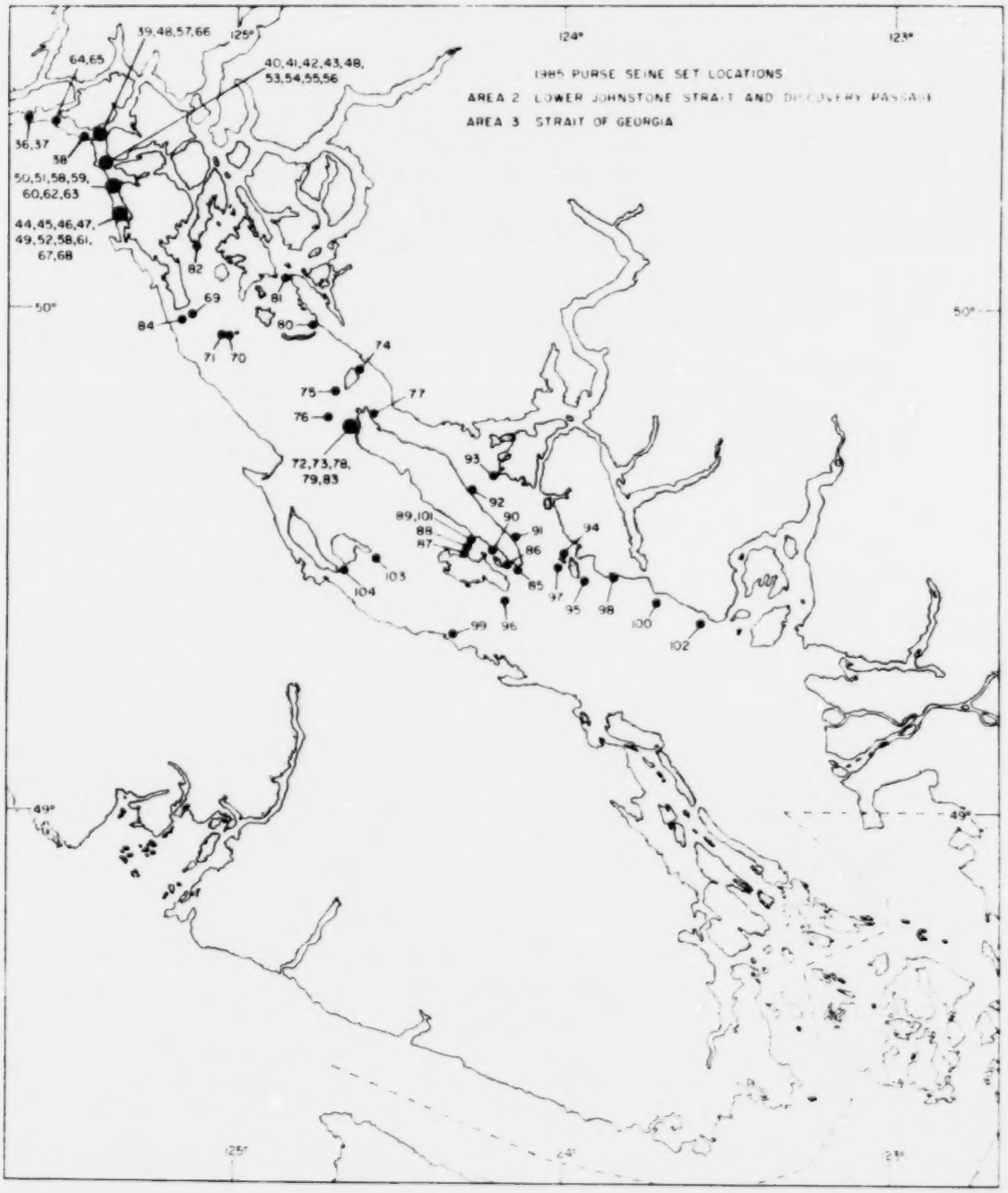

Fig. 3b. Sea Luck set location in 1985, Area 2: lower Johnstone Strait and Discovery Passage and Area 3: Strait of Georgia.

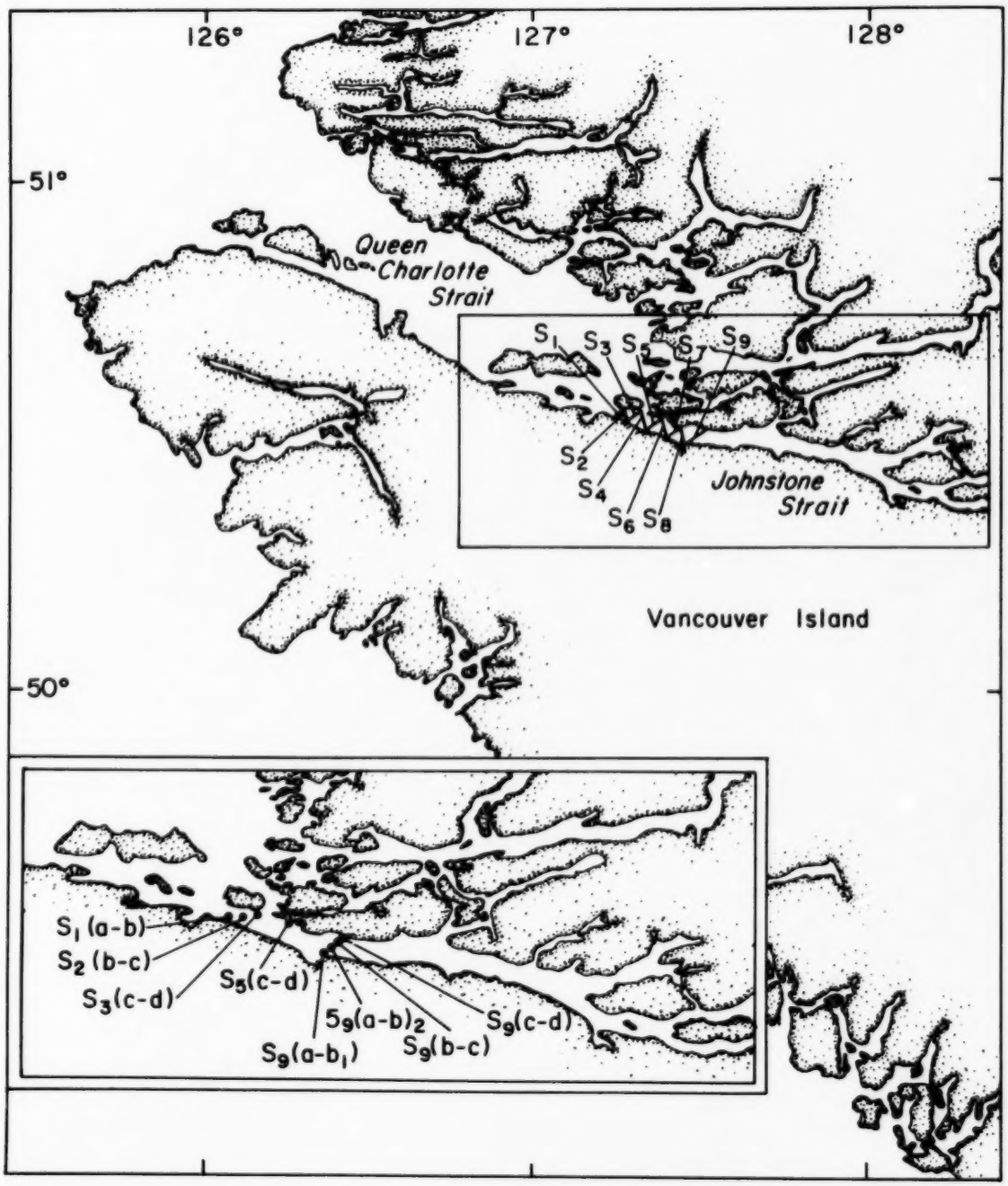

Fig. 3c. Hydroacoustic Transect Series S1 - S9 and set location for transects S1 - S9.

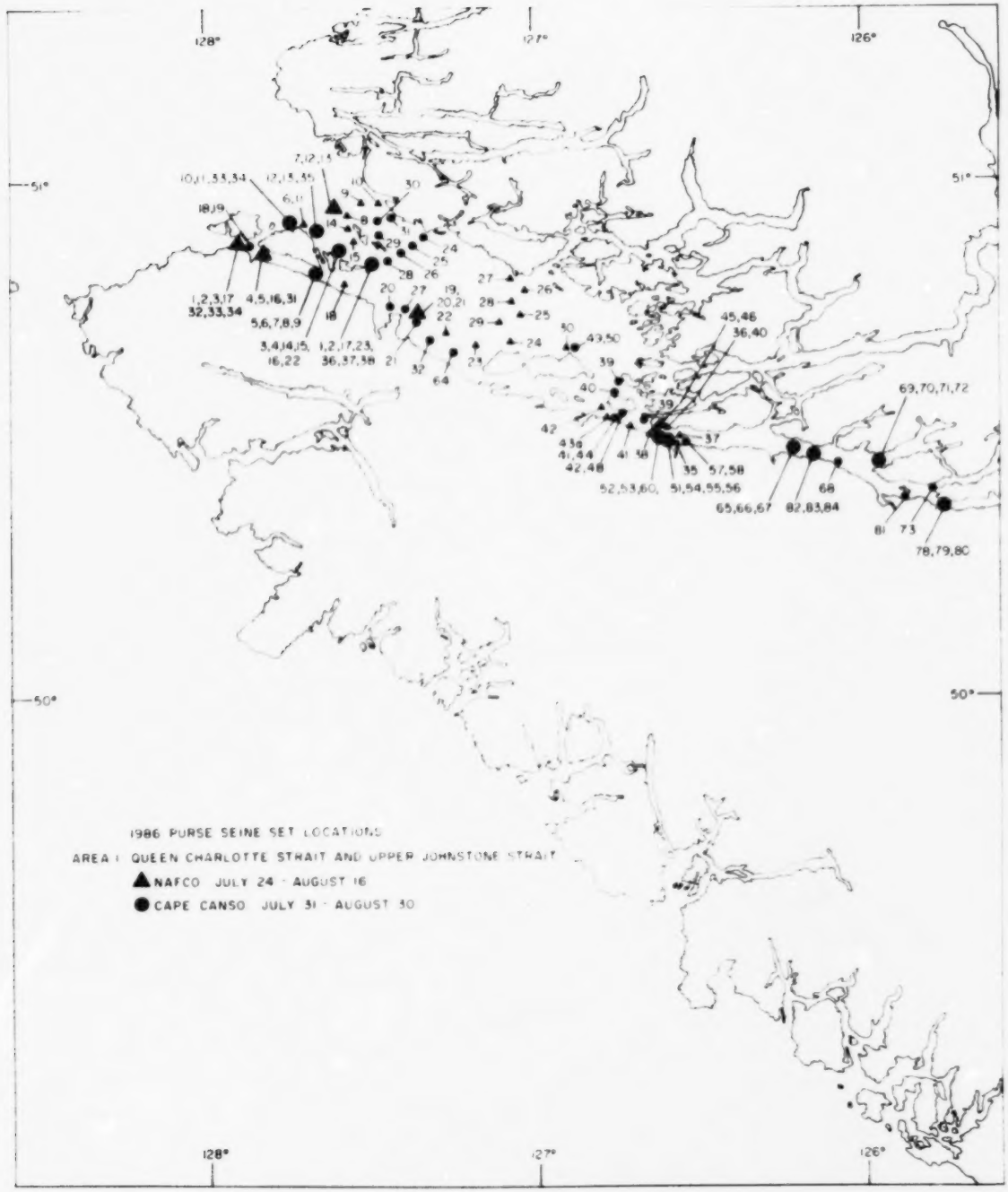

Fig. 4a. Nafco and Cape Canso set location in 1986, Area 1: Queen Charlotte and upper Johnstone straits.

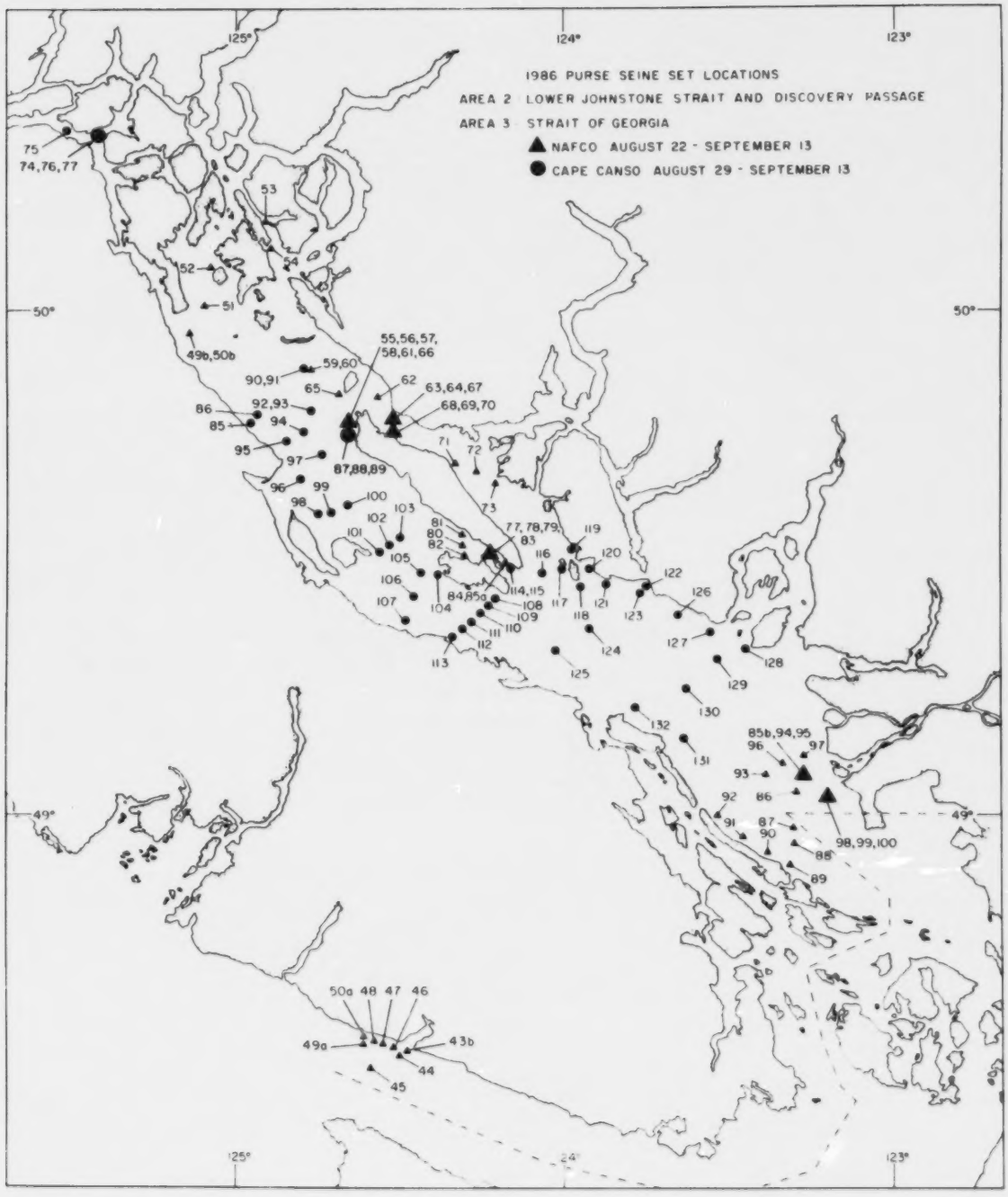

Fig. 4b. Nafco and Cape Canso set location in 1986 Area 2: lower Johnstone Strait and Discovery Passage and Area 3: Strait of Georgia.

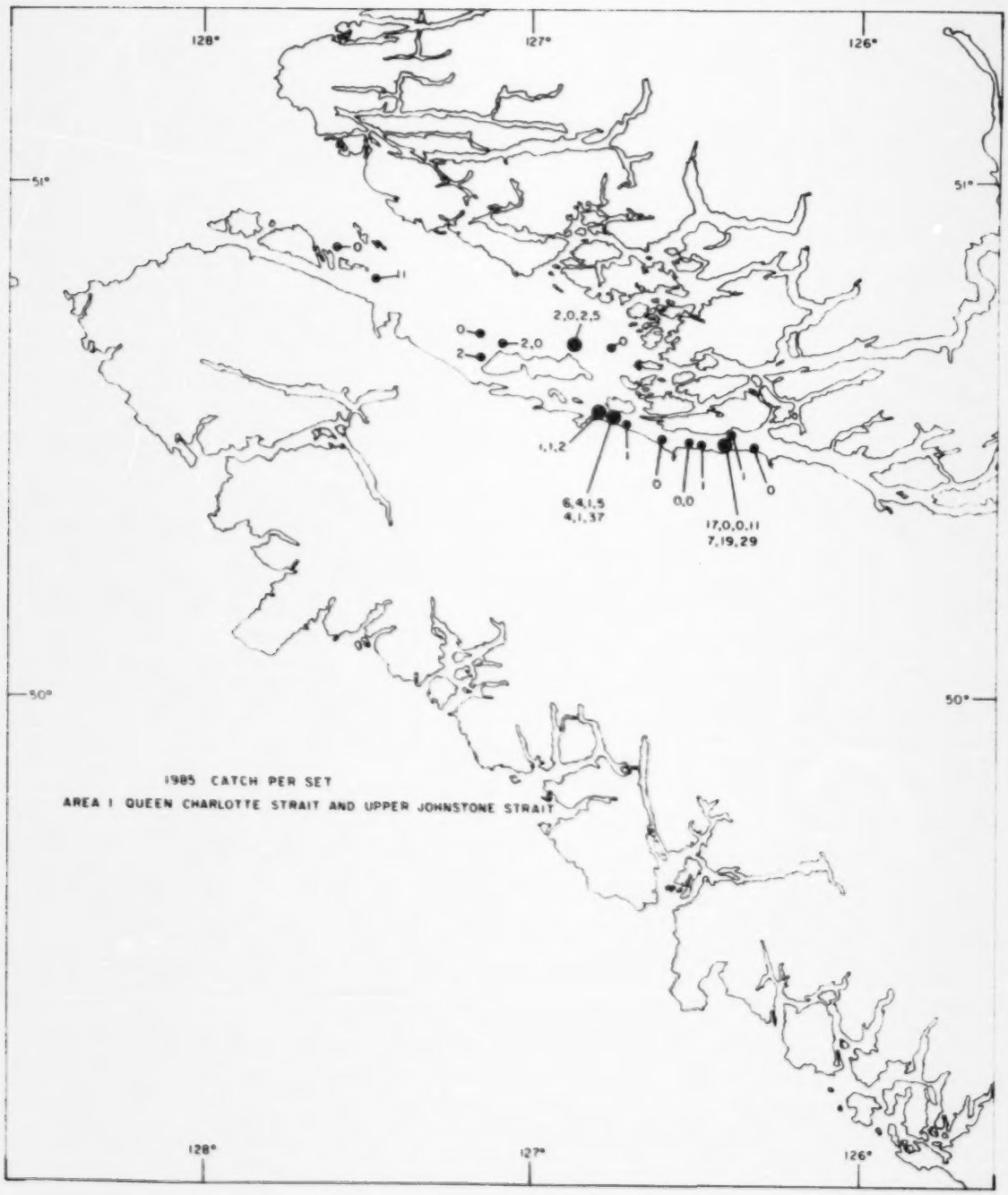

Fig. 5a. Sea Luck catch per set in 1985, Area 1: Queen Charlotte and upper Johnstone straits.

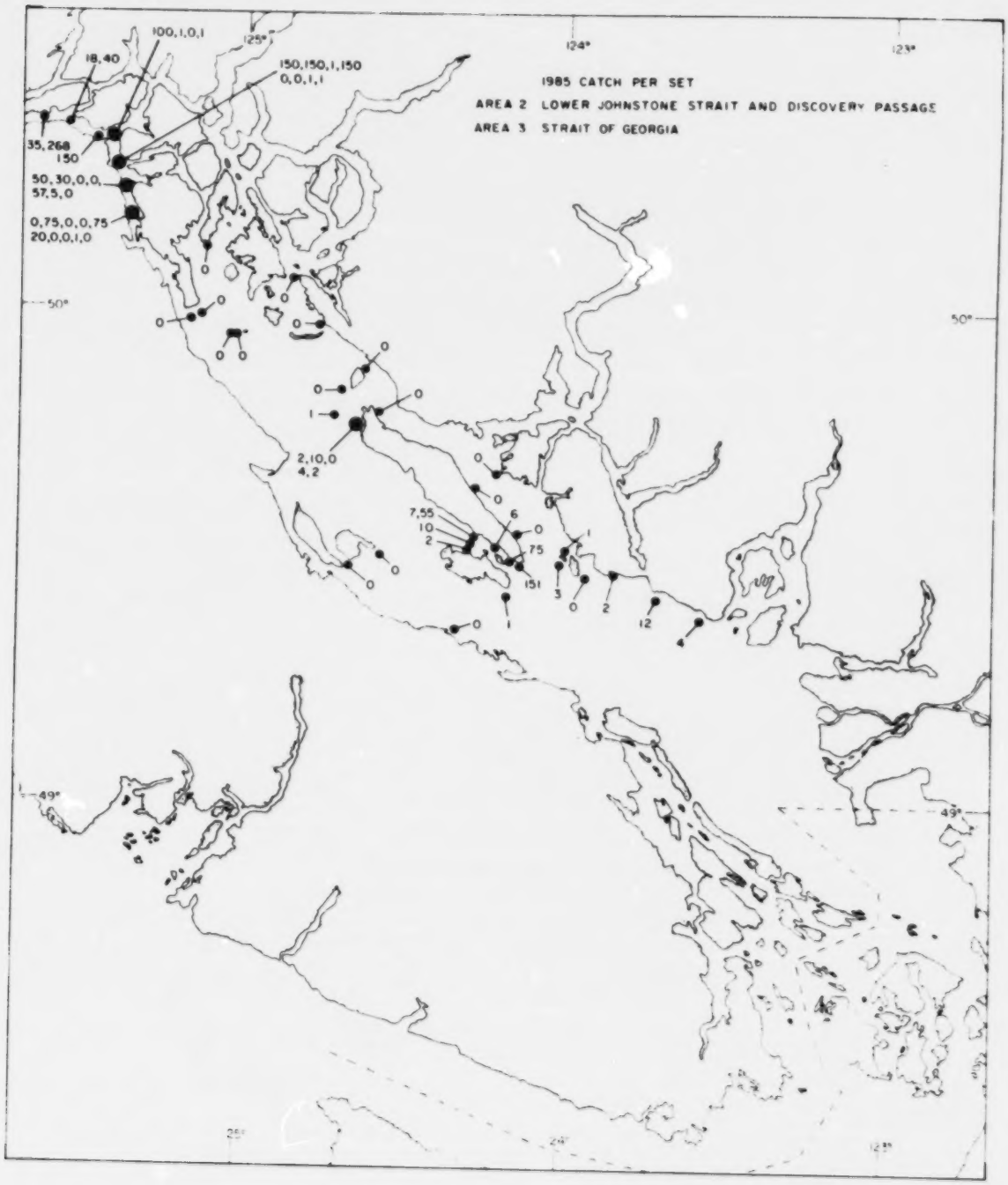

Fig. 5b. Sea Luck catch per set in 1985, Area 2: lower Johnstone Strait and Discovery Passage and Area 3: Strait of Georgia.

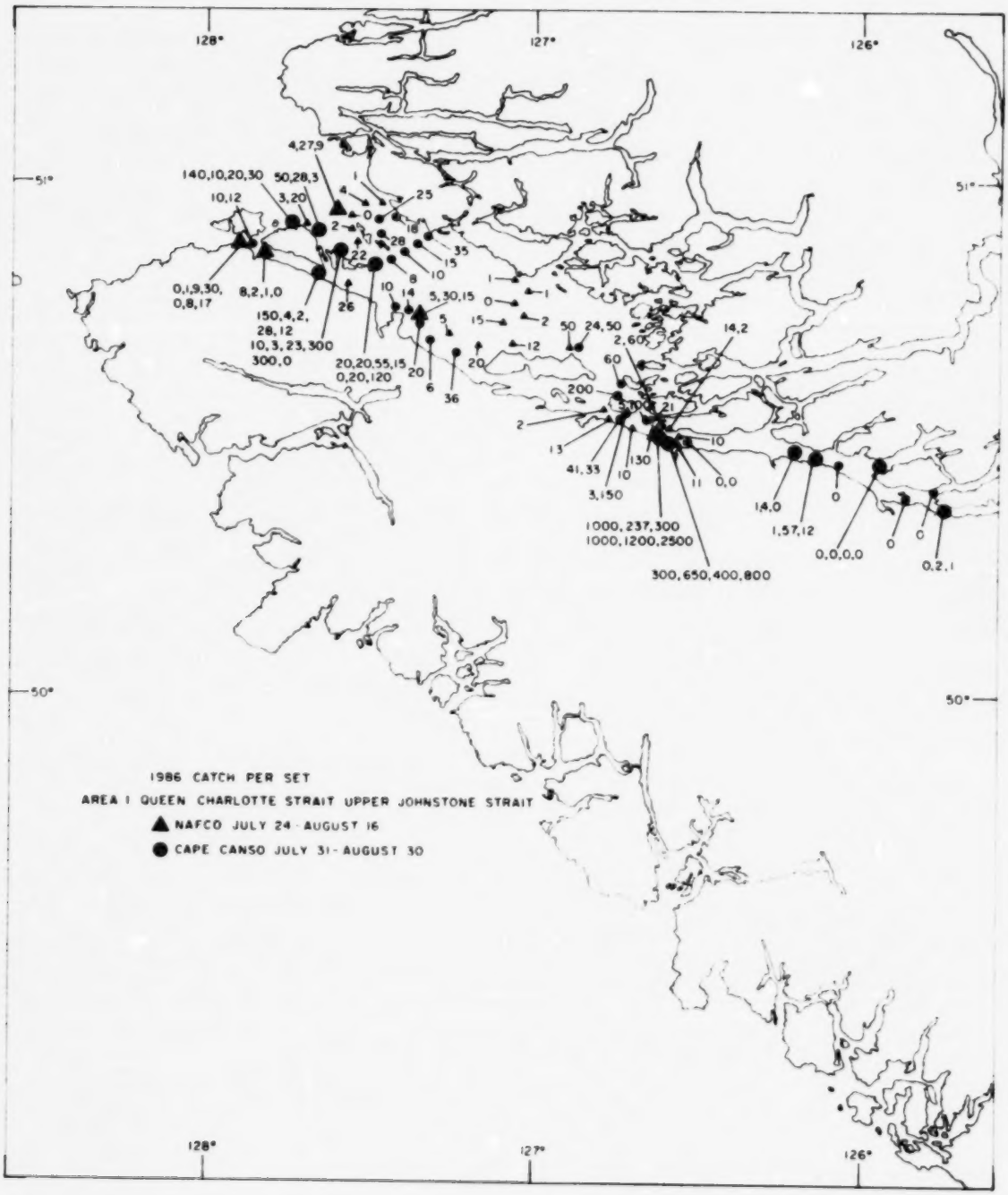

Fig. 6a. Nafco and Cape Canso catch per set in 1986, Area 1: Queen Charlotte and upper Johnstone straits.

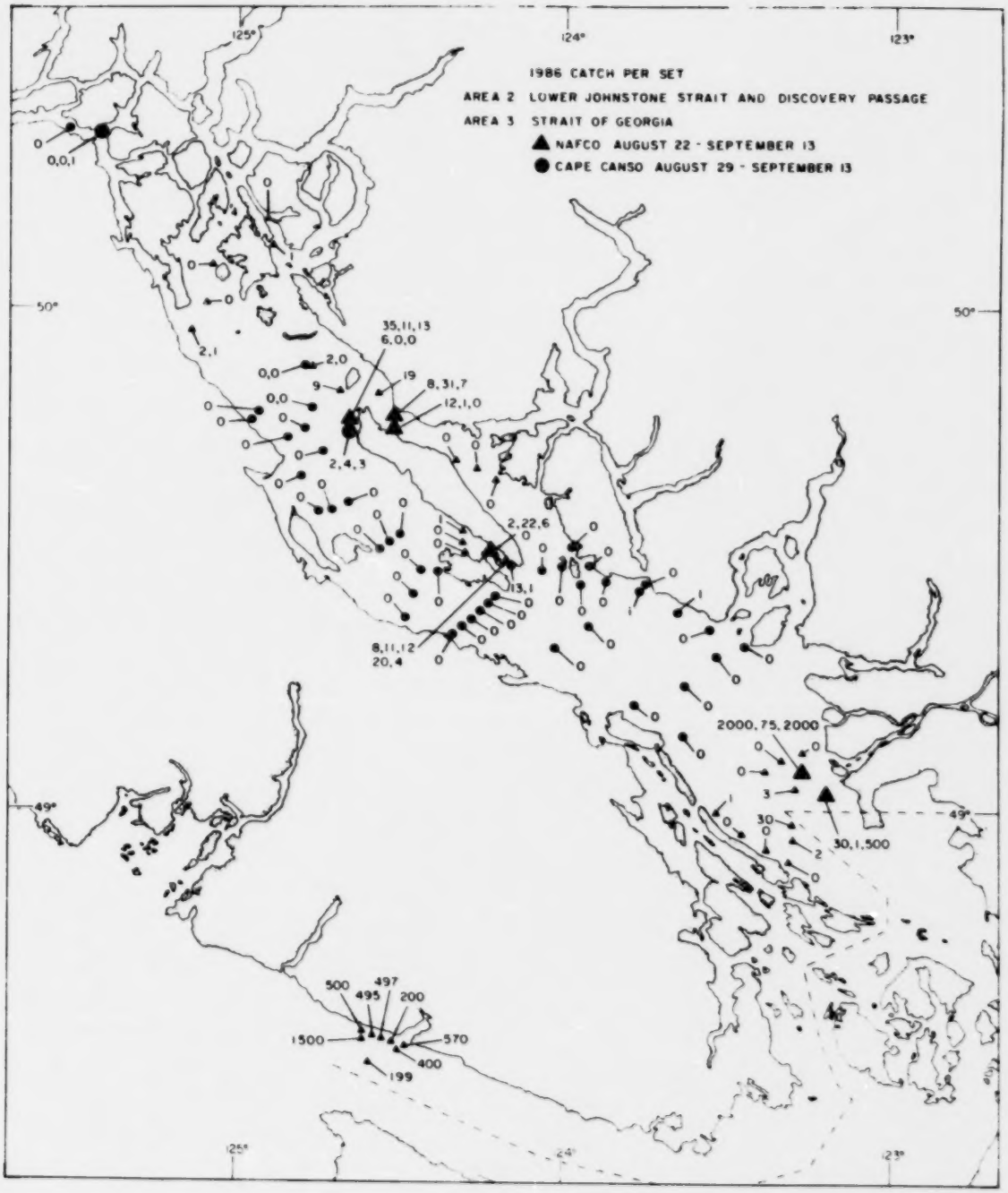

Fig. 6b. Nafco and Cape Canso catch per set in 1986, Area 2: lower Johnstone Strait and Discovery Passage and Area 1: Strait of Georgia.